Toolkit

concept: Parametrics (lines)

Sect. 6.1

Parametric equations: x & y-variables each written as a function of a 3rd variable, or parameter, t.

$X_t = X_0 + at$

$Y_t = y_0 + bt$

a - controls x-axis stretch

b - controls y-axis stretch

X_0 - x-coordinate when $t=0$

y_0 - y-coordinate when $t=0$

endpoints: plug max/min t-values in to x_t and y_0

Slope: $\frac{b}{a}$

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Concept: Eliminating Parameter

Sect. 6.2

Rule/Formula

given two parametric equations x_t + y_t, solve for t on the x-eq. and substitute into the y-eq. for t.

Example:

$x = t + 1 \longrightarrow x - 1 = t$

$y = t^2$

$y = (x-1)^2$

$\Rightarrow y = (x-1)^2$

Reminders:

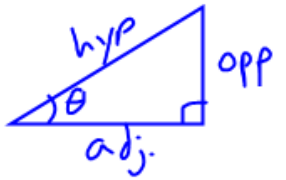
check the endpoints on the parametrics (see above) to see if you need to restrict function.

Toolkit

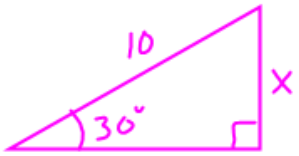
concept: Basic Trig ratios

Sect. 6.3

Rule: $\sin\theta = \frac{opp}{hyp}$ $\cos\theta = \frac{adj}{hyp}$ $\tan\theta = \frac{opp}{adj}$



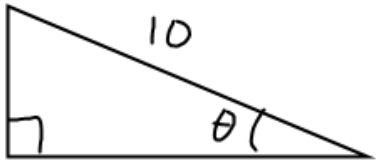
To find side length:



$\sin(30°) = \frac{x}{10}$, $x = 10\sin(30)$

$x = 5$

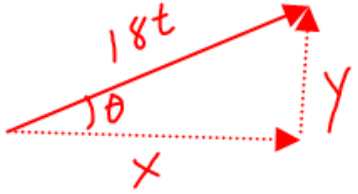
To find Angle:



$\sin\theta = \frac{5}{10}$, $\theta = \sin^{-1}\left(\frac{5}{10}\right)$

$\theta = 30°$

Any Motion can be broken into horz. & vertical components.



$x = 18t\cos\theta$ $y = 18t\sin\theta$

Hints:

- → Make sure you are in degree mode.
- → Only for right triangles (for now)

Toolkit

Concepts: Parametric Shapes

Section 6.4

Rule:

$x = r\cos(t°)$
$y = r\sin(t°)$ > gives a circle

Basic setup

t-min = 0
t-max = 360
t-step = 1-5

- t-min controls first pt plotted
- t-max controls # of rotations (360 = 1, 720 = 2) - may need to adjust by adding t-min if t-min ≠ 0
- t-step controls # of pts plotted, 360 ÷ # sides
- r - controls radius
- add to x to shift rt/lft
- add to y to shift up/down
- add inside w/ t to rotate, $x = 3\cos(t+45)$ > rotates 45°
  $y = 3\sin(t+45)$

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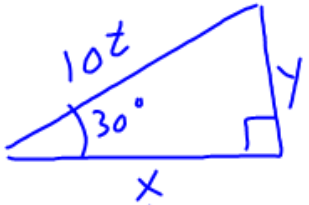
Concept: Wind + river problems

Sect. 6.5

Rule:

→ Any motion can be broken into horz. (x) + vert (y) components

→ Put velocity along with time along actual path, then use cosθ and sinθ to find x + y components



$x = 10t\cos(30°)$

$y = 10t\sin(30°)$

→ If there is a wind or current, make components for that also

Hints

→ ① Picture ② Equations ③ time or angle

→ Distances usually plugged in for x & y

Toolkit

Concept: Wind + river (adv.) – cross currents

Sect. 6.6

Rule:

- Break the plane into its two components
- Break the wind into its two components
- Model the overall motion by adding the two x-components and two y-components
- To get a plane to move straight east or west, the y-comp. of the plane plus the y-component of the wind = 0, then solve for θ.
- To get a plane to move straight North or South, the x-comp of the plane plus the x-comp. of the wind = 0, then solve for θ.

Hints

- picture, equations, Solve for angle
- Use common sense
- convert to heading in most cases